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## CHEMISTRY IN MEDICINE IN THE FIFTEENTH CENTURY

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THERE lies before the writer a stately folio, printed in Strassburg in Alsace in the year fifteen hundred, not written in the conventional Latin of the scholars of the period, but in the German language. It is a work not unknown to historians of pharmacology and medicine, but the significance of the movement it represents and the influence of its publication upon the development of chemistry and of *materia medica* seem not to have received the appreciation it deserves. The title of the work, translated, reads: "The Book of the Art of Distilling Simples, by Hieronymous Brunschwygk, a native and surgeon (*Wundartzot*) of the imperial free City of Strassburg."

The book is noted as one of the earliest printed books giving circumstantial descriptions, with many illustrative wood-cuts, of the apparatus and methods of distillation in vogue with the chemists of the fifteenth century. It is also noted among the early herbals on account of its many descriptions of medicinal herbs with illustrative wood-cuts.

The first division of the book is devoted to descriptions of the construction of furnaces and of the various forms of stills, retorts, receivers, condensers, etc., and of the various methods of distilling: by direct fire, from water bath, by the sun's heat, by the use of the gentle heat of fermenting horse-manure, etc. It is interesting to note that as with still earlier authors on distillation, there is included under this head the distillation "*per filtrum*," which consisted in siphoning, by means of a felt cloth, the liquid from one vessel to another placed at a lower level. This process is then not really distillation, but is what we now call "*filtration*."

Especial emphasis is laid upon the distillation and preservation of "waters" distilled by these various methods from medicinal herbs or from other substances which the pharmacology of the time recognized as of remedial value.

The second division of the work is devoted to the description of many plants and other medicinal agents, alphabetically ar-

ranged, with wood-cuts illustrating them, directions as to the parts to be subjected to distillation, the time or season for their preparation, and the complaints which the distilled waters are supposed to benefit with the doses for their application.

A single example will best serve to illustrate the character of these descriptions.

*Mulberry water*, by the Greeks called *Mora*, by the Arabians, *hoc*, and by the Latins, *Moracelsi*, and by the Germans, *Mulber*, is a tree well known to many. The best part, and the season, is the fruit or berry when perfectly ripe, but not near its falling.

A. Mulberry water, drunk three or four times a day, two or three ounces each time, and also well gargled, dispels the complaint of the throat called quinsy.

B. Mulberry water when drunk every morning, noon and night, for five or six days about four ounces each time, dispels ailments of the chest and stomach and softens and expels excreta.

C. Mulberry water drunk as above directed is good if one has fallen and has coagulated blood, which it scatters and dispels.

D. Mulberry water drunk as above directed is also good for a cough and expands the chest.

E. Mulberry water reduces the veins when rubbed with it and pressed with it (varicose veins?).

F. Mulberry water, when not quite ripe or when ripe is good for the eyes when introduced into them or when they are bathed with it.

G. Mulberry water from unripe mulberries is a principal water for the palate and epiglottis, especially if one gargles well with it three or four times a day, about three ounces each time, for it takes away all rawness and heat from the throat, as I have often observed.

The list of waters similarly described which makes up the greater part of the bulky volume includes distillates from many common plants and herbs, but is by no means confined to these—for the list includes waters distilled from many other substances then accepted by medical authorities as possessing curative powers:—oxen-blood, ants, frogs, frogs' eggs, flies, and many other substances the like of which are now only to be found in the traditional pharmacopeia of China.

The book concludes with a formality characteristic of the period:

Herewith is completed the book called the book of the art of distilling

simples, by Jeronimus Brunschwyg\* surgeon of the imperial free city of Strassburg, and printed by the highly respected Johann Grüninger at Strassburg on the eighth day of May, as one counts from the birth of Christ fifteen hundred. Praise be to God.

The distilled waters of Brunschwygk have left but little trace in the pharmacology of to-day, yet, foreign to modern practise as these remedies are, it is manifest that his work or the practise which it represented exerted a very considerable influence on the popular medicine of the time. The work of which the above is the first edition passed through at least nine editions. It was followed (1512) by another work by the same author on the distillation of composita, extending the system beyond the single substances or simples to more or less complex mixtures, and this work also passed through several editions. Imitations, translations and works by later writers extended the literature of distilled medicines to a very considerable volume, evidencing a very prominent popular vogue of these distillates or filtrates instead of the system of powders, syrups and decoctions which the traditional ancient and university authorities recognized.

So far as the writer has been able to ascertain, the book of Brunschwygk is the first book which presents a system of remedies based upon distilled (or in some cases filtered) waters from the numerous and varied substances familiar to the medical practise of the time.

In this respect it marks a distinct departure from the scholastic medicine of the middle ages, and was without doubt an important agent in the influences operative in breaking down the walls of scholastic conservatism in medicine, and in initiating the revolutionary movement which culminated a century or more later in opening the way to the union of chemistry and medicine.

The author of the Book of Distillation makes no claim to originality in introducing this system of medicines, nor is it probable that his book is other than a formulation of practises in use in a certain group of medical practitioners and especially of a notable group or guild of Strassburg surgeons which attained a very considerable prestige and of which Brunschwygk was the most noted in his time.

The Book of Distillation of Simples, in its general plan of arrangement, except for the part on distillation methods and apparatus, was modeled on the earlier Herbals. These were illustrated descriptions of plants, intended for the more accu-

\* Our author is not particular about the spelling of his name. It is spelled in three different ways in this book.

rate identification of medicinal material, and also included synopses of the virtues of the plants and their application in medicine. The distinct departure of this book from its predecessors lay in the idea of applying the processes of chemistry to the separation of the supposed active principles from these raw materials. The traditional method of utilizing the remedial substances—the method sanctioned by the authority of the Greek and Arabian authors whose teachings were the accepted dogmas of the learned doctors of medicine—was as powders, decoctions, syrups or plasters. The idea of separating a purified principle by distillation or in some cases by solution and filtration was from the point of view of the medical faculties heretical and a phase of ignorant charlatanism.

The theoretic basis of this new medical practise is doubtless to be found in the neo-platonic theories of nature, which under the leadership of the Florentine Academy exerted a strong influence at this period and was at variance with the traditional Aristotelianism of the schools. One phase of this philosophy recognized in all things animate and inanimate a soul or spirit which represented the essential principle as separate from the grosser materials of its body. The then familiar knowledge of the obtaining of alcohol—the “spirits of wine”—and the method of distilling essential oils and perfumed waters, already developed to some extent by the Arabian chemists, served to give a substantial experimental illustration of the theory. By these processes from the gross and perishable raw substances a purified “spirit” or “essence” was obtained. It was in all probability the extension of these ideas to the domain of medicines which gave rise to the practises of the Strassburg surgeons and their fellows or followers.

However analogical and unscientific may have been the reasoning upon which the “distilled waters” school of practitioners, and however little permanent place the medicines of Brunschwygk’s pharmacology have found in modern medicine, it is not to be denied that there was contained in their method the assumption of a fact of importance, that it is possible to extract by chemical methods from many substances a pure principle more efficacious than the crude material from which it is obtained. And it is also true that the historical importance of the movement inaugurated or first formulated by Brunschwygk is not to be measured either by the correctness of its theoretical foundation or by its permanent contributions to medical practise, but by its influence upon its own epoch and the relation of that influence to the future development of

the science. The nature of this influence then is the important consideration here.

Students of the history of chemistry and of medicine recognize the sixteenth century as the rise of the period of "Iatrochemistry" or the application of chemistry and chemical points of view to medicine and pharmacology. Modern historians of medicine generally credit the inauguration of this revolutionary movement to the influence of Paracelsus and his disciples and followers, Crollius, Van Helmont, Thölde (Basilius Valentinus), Glauber and others; and justly so, for the life-long battle of Paracelsus against the medieval slavery to traditional authorities, for open minds to new experiments and observation, and for the recognition of chemistry as a pillar of medical science, was determinative of a new impetus to chemical science and of a breach in the medical profession which eventually won for chemistry its recognition as an essential factor in medical theory and practise.

Without in any way disparaging or minimizing this influence of Paracelsus, it nevertheless seems fairly certain that the influence of the school of chemical physicians represented by Brunschwygk was important in supplying Paracelsus with no inconsiderable part of the basis and the inspiration for his campaign.

Brunschwygk was born at Strassburg about 1450 and died there about 1534. Paracelsus, born 1493, had studied chemistry in the laboratories of the mines of southern Germany and Austria. In 1526 it is recorded that Paracelsus was himself granted citizenship (Burgrecht) in Strassburg and assigned to the guild of "Lucerne" to which the surgeons (Wundärzte) also belonged. It was in the same year that he began his war against the conventional medicine of the faculties at the University of Basel. It is to be remembered that the Book of Distilling Simples first printed in 1500 had passed through several editions before Paracelsus was assigned to the guild of surgeons. Though Paracelsus makes no reference in his works to Brunschwygk or his book, there are many passages in his works which show him to be more or less familiar with the practises and theory which underlie the work of Brunschwygk.

For instance, speaking of Simples, he says:

The virtue in a simple is one and not divided into three, four, five, etc., and a simple needs only chemistry ("Alchemia"), which is nothing different than with the miner or metallurgist, it consists in extracting, not in compounding, it consists in recognizing what is contained in it, not in mixtures and patchwork.

So again referring to chemistry (Alchemia) he says:

If in this (art) the physician is not in the highest degree skilled and experienced his art is all in vain. For nature is so subtle and keen in her affairs, that she cannot be used without great skill. For she yields nothing to us that is perfected in its place (occurrence) but man must perfect it. This perfection is called alchemy.

To such as the author of the distillation book the following passage from Paracelsus, "De Natura Rerum," seems very definitely to refer:

The separation of those things that grow from the earth and are easily combustible, as all fruits, herbs, flowers, leaves, grass, roots, wood, etc., takes place in many ways. Thus by distillation is separated from them, first, the phelgm,<sup>1</sup> then the mercury<sup>2</sup> and the oily parts, third, its resin, fourth, its sulphur,<sup>3</sup> and fifth, its salt.<sup>4</sup> When this separation has taken place by chemical art, there are found many splendid and powerful remedies for internal and external use.

But because the laziness of the reputed physicians has so obtained the upper hand and their art serves only for display, I am not surprised that such preparations are quite ignored and that charcoal remains cheap. As to this I will say that if the smith could work his metals without the use of fire, as these so-called physicians prepare their medicines without fire, there would be danger indeed that the charcoal burners would all be ruined and compelled to flee.

But I praise the spagyric (*i. e.*, chemical) physicians for they do not consort with loafers, or go about gorgeous with satins, silks, and velvets,—gold rings on their fingers, silver daggers hanging at their sides and white gloves on their hands, but they tend their work at the fire patiently day and night. They do not go promenading, but seek their recreation in the laboratory, wear plain leathern dress, and aprons of hide upon which to wipe their hands, thrust their fingers amongst the coals, into dirt and rubbish and not into golden rings. They are sooty and dirty like the smiths and charcoal burners, and hence make little show, make not many words and gossip with their patients, do not highly praise their own medicines, for they well know that the work should praise the master, not the master his work. They well know that words and chatter do not help the sick nor cure them. Therefore, they let such things alone and busy themselves with working at their fires and learning the steps of alchemy (chemistry).

From these and other expressions it seems fairly to be inferred that Paracelsus was cognizant of and sympathetic with the ideas and practise of the distillers of simples.

It is true that the application of chemistry to medicine as visualized by Paracelsus transcended in extent the distilled waters from the conventional remedies of Brunschwygk, and his own practise extended to the use of inorganic salts and com-

<sup>1</sup> Meaning the watery distillate.

<sup>2</sup> With Paracelsus this includes volatile or gaseous products.

<sup>3</sup> That which burns.

<sup>4</sup> The ash or fixed residue.

pounds of metals which would perhaps have been as abhorrent to the chemical physicians of the Strassburg school as they were to the medical faculties themselves. But it may well be true that a large part of the impetus to his campaign was derived from the Strassburg surgeons, and that his own experiences in the chemistry of the mines and the homely remedies of the mining regions supplemented and extended his ideas as to the utilization of chemistry in medicine.

That Paracelsus had knowledge of the Herbals and had a certain contempt for the various claims for the virtues of the remedies therein described is evident from a passage which applies equally well perhaps to the Brunschwygk pharmacology as to its predecessors :

Open one of these Herbals and you will there find how one herb has fifty or a hundred virtues, and open their books of recipes and you will find forty or fifty such herbs in one recipe against one disease.

A better understanding of the significance of the origin of this school of medicine in the guild of surgeons may be obtained if we recall the relation of these to the medical profession in the period which we are considering.

Even under the Roman Empire the occupations of physician and surgeon were separate, as was also the business of collecting, preparing and selling of drugs and medicines.

In the early Renaissance, and throughout the period of the distillation books, the doctors of medicine were very conventionally and generally very superficially trained by lectures or readings in the dogmatic theory and practise of traditional authorities. Their knowledge of physiology and of anatomy was in general slight. Independent observation and experiment were practically inhibited by their oaths of allegiance to traditional authority and by professional caste pride. Custom also dictated that the physician was not to lay hands upon his patient in the way of any operations. In case bleeding or leeching was considered necessary, the barber was called in, in more grave operations—fractures, amputations or internal operations—the surgeon was called upon. It developed that, generally speaking, the doctors of medicine became more and more rigid in their adherence to the dogmatic medical theories, and less and less capable of progressive development.

The surgeons, on the other hand, were in general not men of traditional learning nor necessarily trained in the Latin of the scholarly classes. They learned their art by apprenticeship under older surgeons, and sometimes also in special schools for surgeons. They were not "*doctors*" but "*masters*" (magis-



ter). Theirs was a skilled trade, not a profession. In the wars it was the surgeon who accompanied the troops to dress their wounds and to care for their health. The surgeons were very often also appointed as city physicians (*Stadt-Artzte*) to care for the health of the poor who could not well afford the high fees of the regular doctors nor to pay the prices for their often costly prescriptions of rare and far-fetched medicines.

The surgeons, therefore, very naturally developed a medical practise less founded on scholastic traditions than upon their own experience with popular and homely remedies, though naturally also greatly influenced by the traditional practise of the scholarly physicians. Their practise tended more to an empiricism which, however unscientifically founded, yet had the advantage that it was not bound by the traditions of authority which limited the regular school, and was more open to the reception of new and progressive ideas. The surgeons also, by the nature of their experience in the performing and care of serious operations and their care of the poor, acquired a better knowledge of anatomy than the doctors.

It is not surprising, therefore, that as early as the twelfth and thirteenth centuries in Italy, the thirteenth and fourteenth centuries in France, and soon after in Germany, the surgeons became recognized as a strong and influential group, and that even as medical practitioners were often strong competitors of the regular physicians for popular favor. The names of Lanfranchi, Mondeville, de Chauliac, in France in the thirteenth and fourteenth centuries, and of Brunschwygk and Von Gersdorff in Strassburg, are illustrations of surgeons who attained distinguished eminence. Brunschwygk himself was the author of a work on surgery, apparently the first printed treatise by a German surgeon, first printed in 1497 in Strassburg and passing rapidly through many editions.

The surgeons of the period were then also medical practitioners with a very considerable following among the people, however discredited by the learned classes. But because they were not bound by allegiance to recognized authorities whose teachings were held as almost sacred by the university doctors, they were more open to new ideas and better able to profit by the results of their own experience. Thus their influence grew with the advance in knowledge more rapidly than did the influence of the conservative physicians.

Hence it is that the surgeons were the ones who first took cognizance of the development of chemical methods and phenomena and endeavored to apply these methods to the purifica-

tion and preparation of medicines. And as above suggested it is probable that the neoplatonic idea of the existence in every medicinal substance of a pure essence or "spirit" which was the active remedial agent, was the origin of this first attempt to apply chemistry to the practise of medicine. The author of the "*Liber Destillandi*" himself explains that the distillation of his "waters" is for the purpose of separating the active agents from the impurities which complicate or interfere with their action. To what extent the methods and practices of the Strassburg school represented by Brunschwygk prevailed in other localities at the time is not known to the present writer, but from the fact that the distillation books of Brunschwygk and others enjoyed such an extensive popularity as is evidenced by their many editions and translations, it is evident that their influence was not insignificant. That Paracelsus a quarter of a century after the publication of this first edition of the "*Liber Destillandi*" evidently was to some extent inspired by this movement in inaugurating his campaign for the union of chemistry and medicine, seems fairly to indicate the important place of this early phase of chemical medicine in the history of the application of chemical experience to medical development.

Brunschwygk's "*Liber Destillandi*" appears to be the first published systematic attempt to graft upon the practise of medicine the methods and the theories developed by the early chemists. Though that attempt contributed little of permanent value, it very manifestly assisted in inaugurating the movement for the union of chemistry and medicine which by the campaign of Paracelsus and his disciples developed into a revolutionary movement both in chemistry and in medicine, a movement which since has been continuous and of ever-increasing importance.